Popular Scientific Summary

Optimization of artificial kidneys - electricity in the stomach could be the answer

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Our kidneys work in silence, until they no longer work at all. For about 10 000 Swedes, suffering from irreversible kidney failure, the blood quickly gets poisoned by waste solutes, toxins and excess water. We all have a blood vessel filled membrane in our stomachs, the peritoneal membrane. In many patients, blood purification across this membrane is the only thing keeping them from lethal poisoning and drowning in their own lungs.

A common kidney replacement therapy is peritoneal dialysis (PD), a method where a naturally existing membrane in the stomach is used to filter out waste solutes and water from the patients blood into a dialysis fluid. The treatment modality has benefits in comparison to other dialysis forms as it is considered gentle to the patient, cheep and executed at night by an automatic PD-machine in the patient's home. However, designing an efficient dialysis treatment can be difficult, as the outcome is highly dependent on the transport properties of the patients membrane. To further complicate matters, the transport properties are individual and often change over time. Therefore, medical staff must monitor the properties regularly to adjust the design to ensure an optimal treatment regimen, reducing the symptoms of kidney failure and decreased life-quality to as great extent as possible. Unfortunately, current membrane evaluation methods are time-consuming in clinic performed examinations, and thereby not performed frequently.

In the search of a simpler, automatic and cheeper method to achieve more regular membrane evaluations, a novel method was designed in theory. The method, called the CondPET is based on the fact that many solutes cleared from the patients blood into the dialysis fluid are dissolved ions and thereby transport induce change in conductivity of the dialysis fluid. As the method is new and therefore potentially trumpery in patients, primary calculations were executed using a well-known mathematical peritoneal membrane transport model, describing flow of solutes and water across the membrane during a PD-session. 19 fictive patients were designed *in silico* and simulations of PD-treatment were performed. During the treatment, the conductivity of the dialysis fluid was calculated, which proved that each of the patients had a conductivity ID relating to their membrane transport properties. At least theoretically, it seems that the electrical properties of the dialysis fluid could be used to determine the transport properties. As the patients PD-machine could measure the conductivity automatically during the patient's sleep, this method has great potential to generate frequent membrane evaluations.

As these promising results were gathered from calculations, further studies and most importantly clinical trials in patients must be performed in order to fully validate the method and its potential. If the method is proven useful, this could greatly ease treatment design for doctors as frequent membrane status checks . Foremost, prevalent PD-patients could get their membranes evaluated easily and fast, with the benefit of frequent membrane checks, avoiding time with non-optimal treatment.